

CLAIMS

What is claimed is:

1. A centrifuge comprising:

a rotor assembly rotatable about a rotor axis, the rotor assembly being configured to hold materials for separation;

a first superconducting magnetic bearing comprising:

a first permanent magnet configuration coupled with the rotor assembly so as to rotate concurrently with the rotor assembly; and

a passive first superconducting magnet stator being spaced apart from the first permanent magnetic configuration and the rotor assembly, the first superconducting magnet stator and first permanent magnet configuration being sufficiently close together to produce a magnetic field interaction therebetween; and

a motor coupled with the rotor assembly for selectively rotating the rotor assembly.

2. A centrifuge according to claim 1, wherein magnet field lines of the first permanent magnet configuration penetrate approximately perpendicular into at least one surface of the first superconducting magnet stator.

3. A centrifuge according to claim 1, wherein the position of rotor axis includes an angle from 0 to 90 degrees relative to a horizontal plane.

4. A centrifuge according to claim 1, wherein the first permanent magnet configuration comprises at least one permanent magnet ring or a permanent magnet cylinder, the first superconducting magnet stator being at least partially disposed in radial alignment with the first permanent magnet configuration.

5. A centrifuge according to claim 4, wherein the first superconducting magnet stator at least partially surrounds the first permanent magnet configuration.

6. A centrifuge according to claim 4, wherein the first permanent magnet configuration at least partially surrounds the first superconducting magnet stator.

7. A centrifuge according to claim 1, wherein:

the rotor assembly comprises a rotor mounted on a drive shaft; and

the first permanent magnet configuration comprises a plurality of discrete permanent magnets, each permanent magnet being disposed at a discrete location along the length of the drive shaft, the first superconducting magnet stator encircling the drive shaft.

8. A centrifuge according to claim 1, wherein:

the rotor assembly comprises a rotor having a substantially cylindrical housing projecting therefrom, the cylindrical housing having an inside face and an outside face; and

the first permanent magnet configuration comprises a plurality of discrete permanent magnets, each permanent magnet being disposed at a discrete location on the inside face of the cylindrical housing along the length thereof, at least a portion of the first superconducting magnet stator being disposed within the cylindrical housing.

9. A centrifuge accordingly to claim 1, wherein the first permanent magnet configuration comprises:

a plurality of discrete permanent magnets; and

a collector ring disc disposed between each of the permanent magnets.

10. A centrifuge according to claim 1, wherein first permanent magnet configuration comprises a first permanent magnet concentrically disposed within a second permanent magnet

11. A centrifuge according to claim 1, wherein the first superconducting magnet stator is connected to a cryogenic unit configured to cool the first superconducting magnet stator.

12. A centrifuge according to claim 11, wherein the first superconducting magnet stator is coupled directly to an in-housing integrated cryogenic unit to cool down the first superconducting magnet stator to below the critical temperature and to maintain the superconducting state.

13. A centrifuge according to claim 11, wherein the first superconducting magnet stator has a substantially solid or hollow cylindrical configuration.

14. A centrifuge according claim 13, wherein first superconducting magnet stator is comprised of a melt textured YBCO superconducting material of the composition $Y_{1.3-1.7}Ba_2Cu_3O_{7-\delta}$, wherein the material below $T=92\text{ K}$ becomes superconducting.

15. A centrifuge according to claim 1, wherein first superconducting magnet stator comprises a melt textured multi-grain material of high mechanical stability configured to produce damping properties of the magnetic bearing.

16. A centrifuge according to claim 15, wherein the first superconducting magnet stator comprises a ring-shaped damping discs made from copper, aluminum or their basic alloys.

17. A centrifuge according to claim 1, further comprising:
a passive second superconducting magnet stator; and
a damping disc interposed between the first and second superconducting magnet stator, the damping disc being formed from copper, aluminum or their basic alloys.

18. A centrifuge according to claim 1, wherein the first superconducting magnet stator has the geometry of a ring or hollow cylinder.

19. A centrifuge according to claim 1, wherein first permanent magnet configuration comprises at least one permanent magnet a substantially ring or cylinder like configuration, the permanent magnet being mounted coaxially about the rotor axis.

20. A centrifuge according to claim 1, wherein the first permanent magnet configuration comprises a plurality of axial magnetized rings stacked axially with adjacent equal polarities and comprising a high radial magnetic flux density.

21. A centrifuge according to claim 1, wherein the first permanent magnet configuration comprises at least two annular permanent magnets mounted concentrically one in another in a plane whereby the rings are radially adjacent fitted.

22. A centrifuge according to claim 21, wherein in the radial direction the upper surfaces of neighboring rings show equal or alternating axial magnetization.

23. A centrifuge according to claim 1, wherein the first permanent magnet configuration comprises an integrated lower part of the rotor cup.

24. A centrifuge according to claim 1, wherein the first permanent magnet configuration comprises a single ring or cylinder like permanent magnet.

25. A centrifuge according to claim 1, further comprising:

a second superconducting magnetic bearing spaced apart from the first superconducting magnetic bearing, the second superconducting magnetic bearing comprising:

a second permanent magnet configuration coupled with the rotor assembly so as to rotate concurrently with the rotor assembly; and

a passive second superconducting magnet stator being spaced apart from the second permanent magnetic configuration and the rotor assembly, the second superconducting magnet stator and first permanent magnet configuration being sufficiently close together to produce a magnetic field therebetween.

26. Centrifuge with a rotor unit to process and separate different dense materials has least one bearing and is combined with a driving device rotatable around the rotor axis, wherein at least one part of the rotor unit is influenced by magnetic forces and is characterized in that the rotor arrangement (1) comprises at least one permanent magnet configuration (6, 7, 8, 9, 11, 12, 13, 14; 6', 11', 35) which interacts at given small distance with at least one adjacent superconducting magnet stator (19, 20; 19', 20'; 36) wherein the permanent magnet configuration and the magnet stator comprise at least one passive superconducting magnetic bearing.